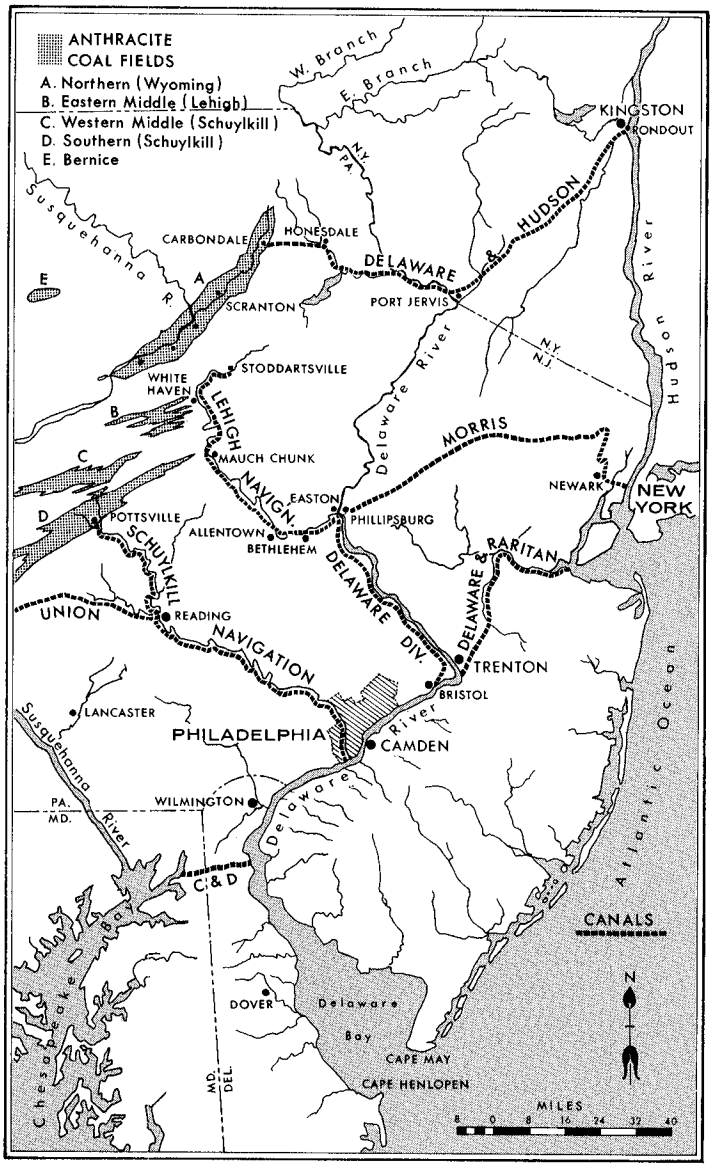
THE UPRIVER CANALS

The impact of canals on the American scene can be assessed most effectively by reference to a historic timetable. The American pioneer canal era belongs to the early Nineteenth Century; removed from this context any effort to evaluate it results in distortion. The early developers and their principles ranged the human gamut from lofty public interest to the barest self-serving greed. Politicians lauded or denigrated programs for traditional political motives. Many of the early works thrill by the daring of their concept, and the aptness of their solutions. Others were ill-timed, ill-conceived and wasteful, and not a few were products of engineer virtuosi with a Mt. Everest syndrome, who did it "just because it was there."

The canals served the needs of the people when those needs were for communication, expansion, growth and development. That they served well their very obsolescence attests, for their essential product was an acceleration in the momentum of living and a new climate of progress which could be supported only by more evolved systems replacing the old. Though blundering, extravagant, wasteful and frequently scandalous — they were successful in this: They laid the considerable foundation for all future American transportation systems, which bound and strengthened a developing Nation.



The upriver canals eventually hauled every kind of cargo, but their motivating purpose was transportation of coal from the anthracite fields of Eastern Pennsylvania to the large city markets.
Although separately owned and operated, the several links of the network developed into a system of interdependent common waterways.

Union Canal[1]

A limestone bed situated west northwest of Reading, Pennsylvania will be part of the storage basin for some 4.7 billion gallons of water when Blue Marsh Dam is completed. Concerns of Philadelphia District engineers in this area today are akin to those experienced by Union Canal engineers in 1824, when Loammi Baldwin and Canvass White had to solve the problems posed by the filtering characteristics of the limestone base. The old Union's 77-mile ditch and 91 locks are long abandoned and the eight miles of its blurred remains in the Reading limestone area will soon be submerged by the waters of the Blue

Schuylkill Navigation lock below the falls at Fairmount, Philadelphia, as it appeared just prior to its removal. The site is now occupied by the Schuylkill Expressway.

Marsh impoundment. Still surviving, are records of those early engineers' solutions to problems which, in the context of their times, seem staggering.

The Union Canal was one of seven upriver pioneer navigation routes undertaken within the precincts of the District in the initial period of the Country's internal improvement. Six of these (the Union excepted) comprised the Country's first network of transportation routes devised as a system. The system's intended function was primarily to haul coal. Today its function is superseded, its facilities outmoded, but the purpose for its creation and the genius which planned it provide background and a credible link to the wonders of modern engineering. Canvass White did not succeed in finding a solution to the leaky limestone bottom — a solution quite accessible to today's engineers, backed by experience in geology, hydrology and soil mechanics. White's answer was to provide more and more water. A 45-foot high dam was built across Swatara Creek, creating a reservoir with an area of 700 acres, from which water was pumped into a 22-mile feeder canal starting at Pine Grove and emptying into the summit level at West Lebanon. Along with this virtuousity White produced another showpiece in America's second tunnel, then the longest at 729 feet. The purpose of the tunnel was not showcase, but avoidance of a costly series of locks over a long ridge which could not practically have been skirted.

The original purpose of the Union Canal was the transport of farm produce, lumber, food commodities and general merchandise. Coal, the prime cargo and motivation of the other six upriver canals, was generally unknown in 1762 when the Union's first route was surveyed between Middletown and Reading under charter of the "Schuylkill and Susquehanna Canal." In 1831, its fourth year of operation[2], it still carried more grain, iron, whiskey and lumber than coal, although huge quantities of anthracite had been streaming down the adjoining Schuylkill Navigation since 1825. The small locks, 8-1/2 feet wide and 75 feet long, could not accommodate the coal boats of the Schuylkill, where locks were twice as wide and 90 feet long. It is said that the first boats to ply the Union Canal were built six miles away and hauled to the water on hay wagons. Although enlarged in the 1840's the Union remained a secondary traffic route.[3]

Benjamin Franklin was writing from London to S. Rhodes, the Mayor of Philadelphia in 1772 when he offered his opinions concerning certain contemplated canal works. With special reference to the projected Schuylkill and Susquehanna (later Union) he wrote:

> *"I think it would be saving money to engage by a handsome Salary an Engineer from here who has been accustomed to such Business. The many canals on foot here under different great Masters are daily raising a number of Pupils in the Art, some of whom may want Employment hereafter, and a single Mistake thro' Inexperience in such important Works, may cost much more than the Expense of Salary to an ingenious young Man already well acquainted with both Principles and Practice."*

The "single mistake" in the Union's planning was in the restricted scale of the lock chambers and channel prism. The choice was made deliberately by an ingenious young man of considerable experience, governed principally by the prospect of a strictly limited water supply. White had theories, too, about the need for a line of small vessels, to carry loads which would exact light tolls and attract a great volume of light traffic. This could happen only while the canals held sway as the supreme transportation medium. When railroads began to compete, inroads were first made on the canals' light freight and passenger business. The survivor canals were those capable of remaining competitive by cheaply transiting heavy bulk freight.

In the same letter, with respect to development of the Schuylkill River for commercial navigation, Dr. Franklin expressed misgivings:

> *". . . Locks in Rivers are subject to many more Accidents than those in still water Canals; and the Carrying away a few locks by Freshets of Ice, not only creates a great Expense, but interrupts Business for a long time till repairs are made, ... Rivers are ungovernable things, especially in Hilly Countries. Canals are quiet and very manageable."*

Schuylkill Navigation

Franklin did not live to see the completion of any of the canal projects which had captivated his interest. The Schuylkill River was developed between 1816 and 1825; it was called the Schuylkill Navigation and consisted of a series of slackwater pools, dams and short canals. As Poor Richard might have predicted, it underwent numerous changes, most occasioned by the seasonal rampages of the river itself. In 1825 its length was 108 miles from Mount Carbon to Philadelphia, with 38 dams and 116 locks. By 1905 navigation had been curtailed above Port Clinton, reducing its length to 90 miles. There remained 19 dams and 44 locks, some of which had been rebuilt several times.

A renowned feature of the Schuylkill Navigation was the first tunnel built in the United States, a 400-foot shaft through the end of a low ridge just above Pottsville. An object of curiosity and tourist interest, for which it was obviously intended, its excavation could have been avoided by a minor shift in the channel's course. Of more than passing interest are the names of the three brothers who contracted to build it: Job, Samson and Solomon Fudge.

Lehigh Navigation & Coal Co.

Some of the early river "improvements" could more accurately be termed exploi-

Josiah White

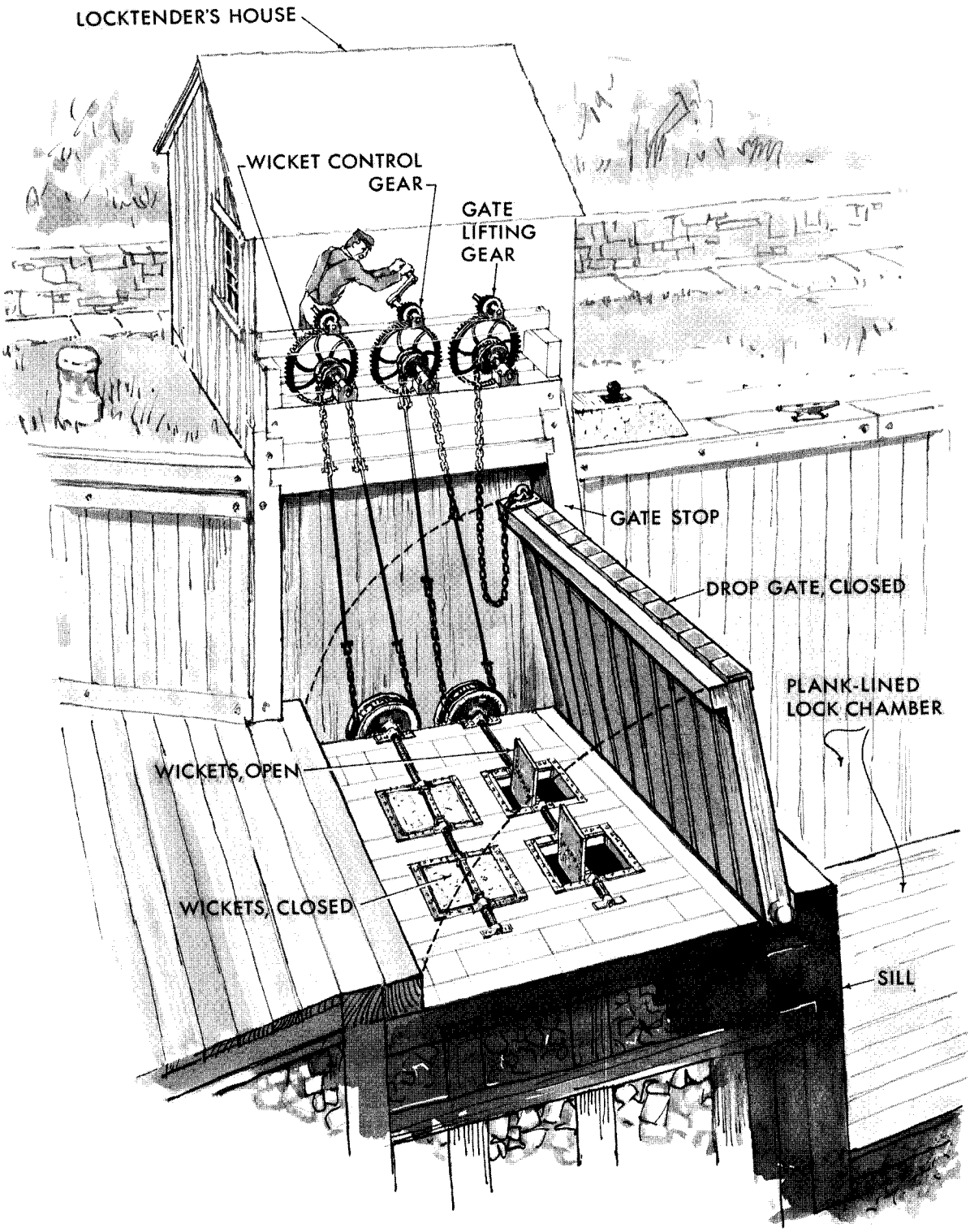
tation. The first works on the Lehigh, for instance, were intended solely to facilitate the transport of coal, to the benefit of many, no doubt, but grounded more in profit than in public interest. The prospect of using the Lehigh as a navigation route required the vision and doggedness of such a rare individual as Josiah White. Rocky, full of rapids, and steeply pitched as were few other eastern rivers, the Lehigh was totally unnavigable in the dry season. With the spring thaws and autumn rains it became a raging torrent, rendering passage on it extremely perilous. Its potential as an avenue of commerce was held in such low regard in 1818 that Pennsylvania legislators only reluctantly granted White's petition to improve it, assuring him and his partners they were being allowed the "privilege of ruining themselves."

Josiah White, born in 1781, appears to have been one of those rugged pioneers, possessed of prodigious gumption and ingenuity, who shaped early Nineteenth Century events with the irresistible momentum of a juggernaut. With his partners, Erskine Hazard and George Hauto, White organized the Lehigh Navigation Company in August, 1818 and persuaded a number of Philadelphians to invest $50,000 in the enterprise on a speculative basis. Since 1817 the trio had been lessees of a charter titled Lehigh Coal Mine Company, under which 10,000 acres situated on the upper Lehigh River could be mined. The charter required rental payment of one ear of corn per year and stipulated that annual shipment of 40,000 bushels of coal to Philadelphia should begin within 3 years.

White and Hazard explored and surveyed the river from Stoddartsville to Easton in the Spring of 1818, on foot and using levels borrowed from a Benjamin Morgan. Their first idea was to narrow the channel and thus raise the water level, by piling stones along the sides of the stream. This scheme was quickly replaced by a plan which White called his "system of artificial freshets." Dams of timber cribbing and rock were built across rapids; these dams were shaped in a vee pointed downstream with a gate at the vertex. A succession of dams formed a series of pools in steps. Loaded coal arks were passed through the gates[4] as the next lower pools became sufficiently filled. Construction was begun in the summer of 1818 with a crew of 13 and White himself the hardest worker. "I was in the water as much as out of it for about 3 seasons --- my cloths dried on my back." By the end of summer the work force numbered seventy.

River arks were 16 to 18 feet wide, 25 feet long, of rough timber reinforced with iron work. It was soon found that hitching boats together would increase profits. Eventually, strings of arks up to 180 feet long were floated down to the Philadelphia markets. After delivery of the cargoes the arks were broken up, the lumber sold and the iron work carried back upriver with the boatmen on Company wagons. This crude type of navigation was continued through 1824. That year the Lehigh boatmen delivered 9,500 tons of anthracite to Philadelphia and the market demand was increasing. The imminent completion of the Erie Canal was stirring expectations of great prosperity and surveys had been made for the Morris Canal, which would start at the mouth of the Lehigh and cross New Jersey from Phillipsburg to Newark Bay.

The partners decided they needed a canal; the growing demand for coal could not be



Introduction of the drop or fall gate brought a great improvement to canal operation. Its origin is attributed to the "bear trap" gate first used by Josiah White in 1818 on the Lehigh River. Eventually, the drop gate became the standard head gate for the locks of most American canals.

Each canal had its own variation of this basic arrangement. When closed, the gate was held in place by the head of water. The wickets were opened to admit water to the lock through sluices in the sill. When the water level in the lock reached the upstream level and pressure was equalized, the seven-to-eight ton gate dropped by gravity to its open position on the top of the sill.

In this conjectural rendering the near wall of the lock and part of the locktenders' house are omitted.

satisfied by the precarious open river navigation. Accordingly, new funds were raised and Canvass White was engaged as chief engineer. With Josiah White as superintendent the construction got started in 1827. The Company was then known as the Lehigh Coal and Navigation Company and had thus been incorporated in 1822. Under this name the Company still operates, one of the oldest corporate entities existing in the United States.

The new work followed the system used on the Schuylkill Navigation: dams, slackwater pools and canals with locks. From Mauch Chunk to Easton 37 miles of canal were constructed. In this reach there were pools for a cumulative length of 9 3/4 miles. On the upper reaches, Mauch Chunk to White Haven (24 3/4 miles), and thence 13 1/2 miles to Stoddartsville, the old system of navigation was maintained. The canal had a surface width of 60 feet, bottom width of 45 feet and a depth of five feet. The locks were 22 feet wide, 100 feet long and were built of stone found along the river. A fortuitous asset to the project was the discovery of large deposits of limestone suitable for processing into hydraulic cement. A mill was set up by the Company at Lehigh Gap (now Palmerton) where the rock was of superior quality. Samuel Glace operated the mill from 1826 to 1830 and later operated another cement mill at Siegfried's Bridge (now Northampton). Glace was a section supervisor on the Canal until 1841. From his records we learn that the stone was roasted in "draw kilns," crushed by a "machine like a corn crusher" and ground like grain by burr millstones. The cement was hauled in scows to wherever needed on the canal; much of the mill's output was used to bond the native stone of the locks. Lehigh cement would become a huge industry in the valley; in 1837 Seigfried's Bridge Mill had a capacity of 10 barrels per day.

The canal was completed in July 1829; the packet boat "Swan" was put into the canal the same day the water was introduced. Two days later several coal barges arrived at Easton and the price of coal dropped. Cost of the canal was $800,000. In 1830 the Canal hauled 41,750 tons of anthracite. A year later the last of the arks made the trip. Seventy thousand tons were hauled in 1832, the year the Delaware Division Canal opened between Easton and Bristol.

Disaster struck in January, 1841 with the worst flood of record in the Lehigh Valley. Destruction of the canal works was almost total. Josiah White, age 60, moved through slush and snow for two days examining a 34-mile stretch of devastation between Easton and Lehigh Gap. His decision was to rebuild, but his stockholders viewed the situation as hopeless. To raise money the company mortgaged all of its assets. Reconstruction was started immediately and the company was back in business within two years, after spending $600,000 on repairs.

Josiah White died in 1850 in his seventieth year. His life and interests had spanned the eras of the turnpike, the canal and the railroad. All three had benefited from his ingenuity and drive. White had lived to see the Old Company exceed an annual haulage figure of 700,000 tons of anthracite. The first train of the Lehigh Valley Railroad ran from Easton to Mauch Chunk in 1855. The road was built by another man who was going

places, Asa Packer,[5] former boatman and miner with the Canal Company. Annual tonnage figures continued to soar despite the railroad's competition, reaching an all-time peak of 1,338,375 tons in 1860, a year which records 2000 boats in operation on the Lehigh.

The flood of 1862 destroyed the dams above Mauch Chunk had caused abandonment of the reach to White Haven, a section which had always been most difficult to navigate. Reconstruction was contemplated, but recent legislation prevented it, the lawmakers contending that collapse of the upper dams had been responsible for the disastrous flooding. By 1923 silting due to mine outwash caused partial curtailment of traffic between Mauch Chunk and Slate Dam (formerly Siegfrieds Bridge), a distance of 23 miles or one-half the remaining canal. In 1924 one hundred thousand tons of anthracite coal were hauled by canal; dredges, operating above Slate Dam for the same period recovered 175,000 tons of slack coal from the river bottom. In December of 1931 the last "*Chunker*" of the Old Company made the trip down to Easton, then through the Delaware Division Canal to Bristol.

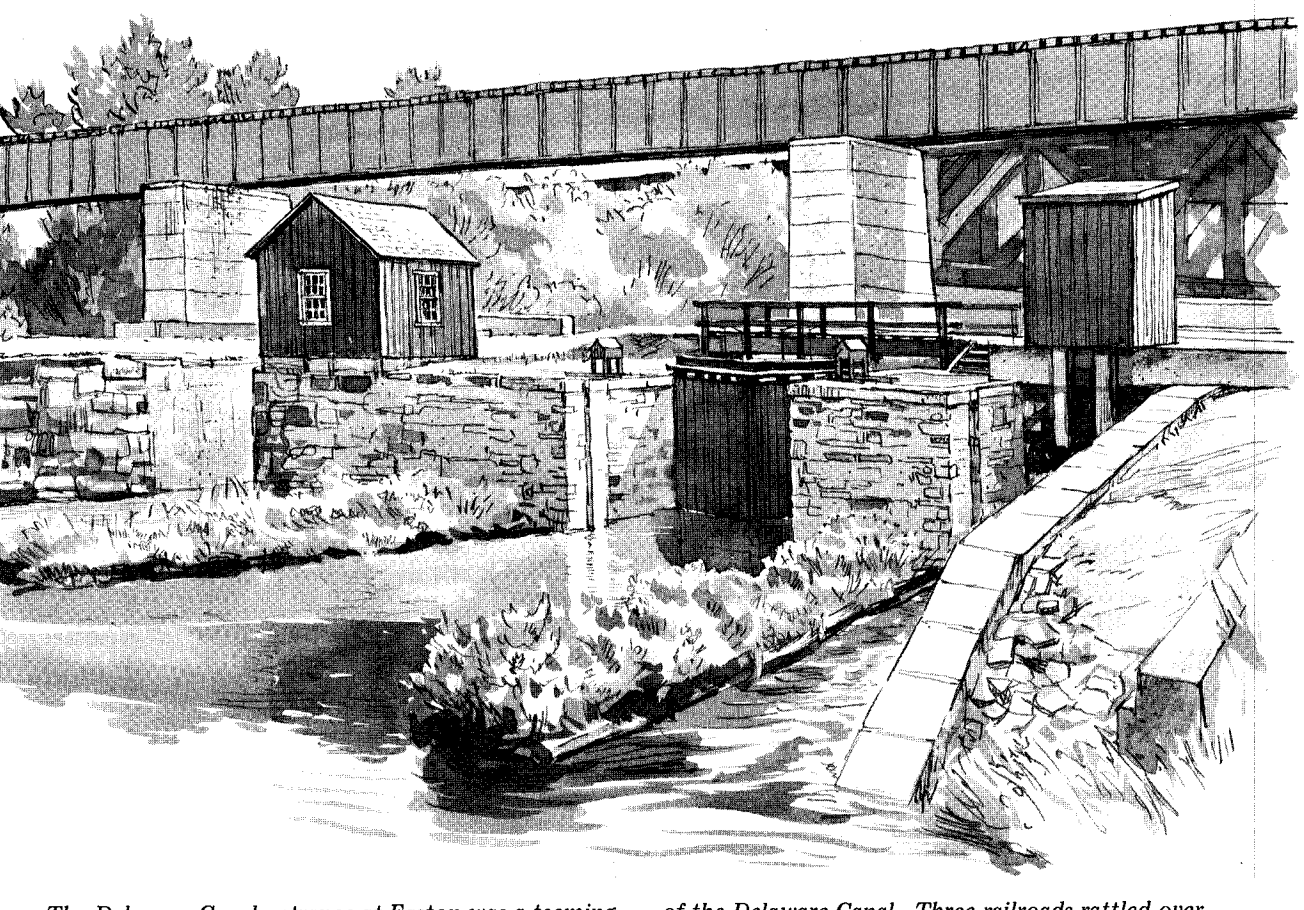
Delaware Canal

Contrary to Josiah White's advice, the Delaware Canal[6] was not constructed after the pattern of the Lehigh and Schuylkill systems. Its 60-mile length was man-made channel all the way. To White's keen disappointment, completion of the Delaware Division lagged several years behind the opening of his Lehigh Navigation, causing serious revision of plans; arks had to continue in use for the river haul below Easton; attention had to be given the leaky channel and barges of special design had to be furnished for passage through the narrow Delaware locks. This link in the system was strategic to the efficient operation of the anthracite line to Philadelphia. White's recent appointment as Canal Commissioner for Pennsylvania gave added meaning to his concern for the canal's efficient performance.

In order to supply adequate draft for 100-ton barges it was found expedient to add thirty inches to the height of the banks. Lehigh cement was brought down to plug up the leaks, some of which were due to shoddy workmanship. Although a boat had made the passage between New Hope and Bristol in December of 1830, that section of the canal (about one-half) was not opened to traffic until 1831. Digging had begun at Bristol in 1827 and had progressed favorably across the nearly flat terrain, one section of which, below Yardley lock became known as "seven mile level." From New Hope northward the going was more difficult. Nine aqueducts were required to carry the channel across streams and guillies and a greater amount of digging was required through the hill country. For miles the channel edged narrowly between river and bluff and at Nockamixon Narrows one of the double locks appeared dwarfed beneath a sheer cliff of shale 500 feet high.

The canal opened for business in September, 1832. Water was received at the Easton summit from the impoundment of a low dam across the mouth of the Lehigh River. From this pool an outlet lock gave access to the Delaware River and to the entrance of the Morris Canal on the New Jersey side. The Morris had begun operations only a few

months previously. The drop from Easton dam to tidewater at Bristol Basin was 165 feet, an average of seven feet for each of the 24 locks. A junction was made with the Delaware and Raritan Canal in 1840; using a current-operated cable crossing between New Hope and Lambertville, boats were able to enter the Raritan feeder and shorten the route to Trenton, New Brunswick and New York. At New Hope, a wing dam and liftwheel were installed in the river to raise water to the canal. The statistical record of the Delaware Canal is largely a carbon copy of Lehigh Navigation figures, since its prime cargo was anthracite, its major function an extension of the route from the mines to Philadelphia. The fortunes of the two lines became inextricably linked.



The Delaware Canal entrance at Easton was a teeming transportation junction. Its gates gave access to the traffic of three canals, the Lehigh, the Delaware and the Morris and admitted feed water to the high level of the Delaware Canal. Three railroads rattled overhead on bridges spanning the canal and the Delaware River. The Easton locks were restored recently and a museum of canal memorabilia was installed nearby.

The "protected" channel of the Delaware Division was vulnerable to the same great storms that nearly wrecked the Lehigh in 1841 and 1862. David Connor, superintendent at Easton reported to the Canal Commissioners on 9 January 1841:

> *". . .The water in the Delaware and Lehigh Rivers rose so rapidly on the eve of the 7th inst., and speedily inundated the lower part of our town, so that it is with difficulty that those living in that section escaped with their lives, their property nearly all destroyed. The Delaware rose to the unprecedented height of 32 feet, which is seven feet higher than it was ever known to have been within the recollection of the oldest inhabitants. The bridge across the Lehigh at this place has been swept away, and in fact every other bridge on the Lehigh so far as we can learn. . ."*

Superintendent Harmon reported:

> *"I hasten to inform you that we have one of the most awful rivers that has been known by our oldest residents. . .it has swept all before it. All the bridges from Easton to Trenton are swept clear. Houses and barns and even men were swept down the furious element."*

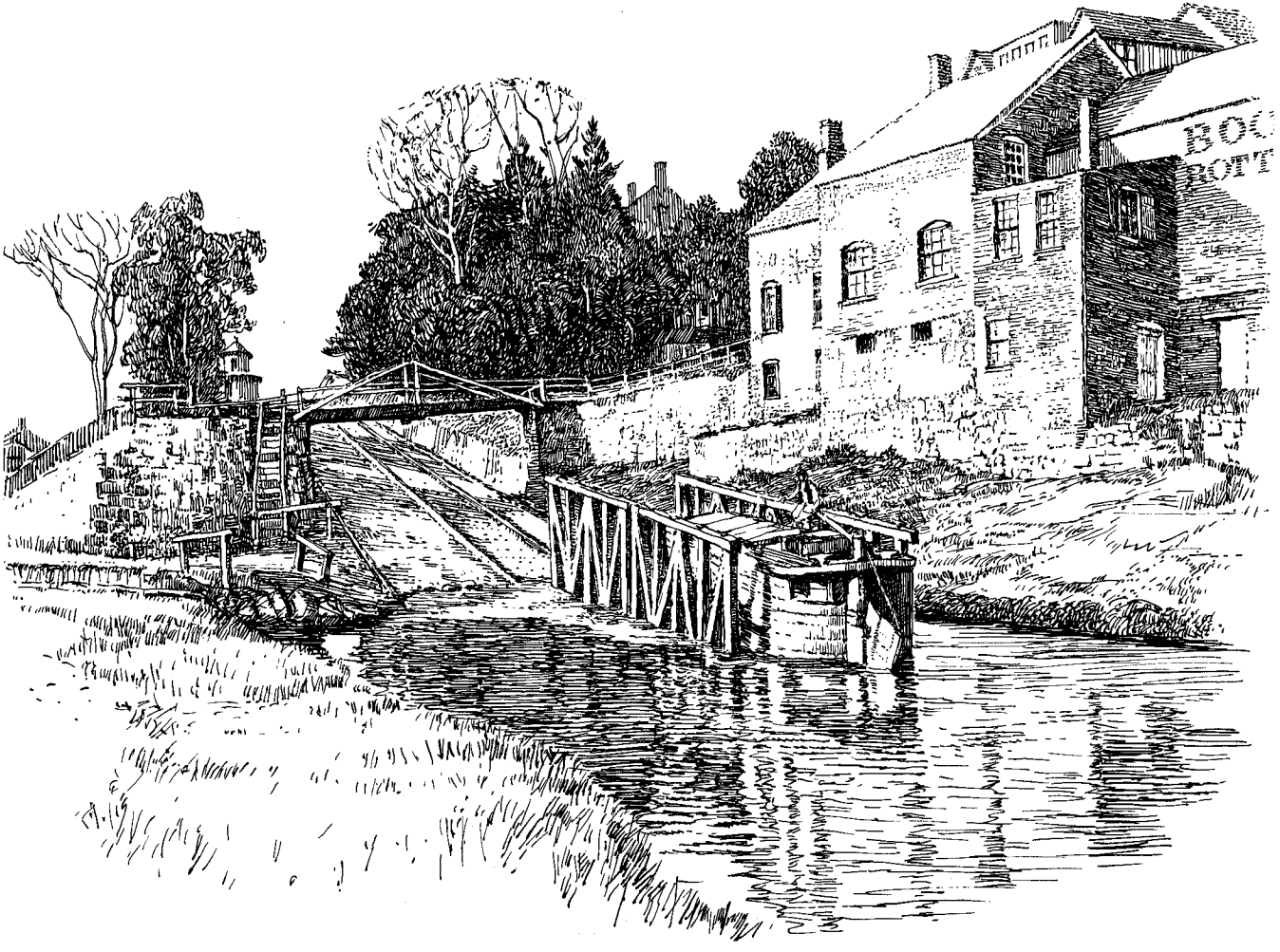
Damage to canal installations was extensive. The Easton dam stood up, though impaired, but the basin embankment, lock house, collector's office and outlet lock were washed away. Stretches of channel were filled with debris and wrecked boats; the river side embankment was breached in many places.

The Delaware Division resisted change right up to its final years. A major expansion of its works was never undertaken as had been done on other canals. The locks were of two sizes: 12 single locks 90 feet long and 12 feet wide and 13 double locks 90 feet long and 22 feet wide. Experiments with steam traction, attempted in the early 1900's, revealed that even minimum speeds of tugs caused a wave wash highly injurious to the canal banks. The plodding mule retained the tow line to the last trip. The canal had various owners other than the Commonwealth of Pennsylvania. It went to the Sunbury and Erie Railroad in 1858 and soon thereafter came under control of the Delaware Division Canal Company.

In its last years it was operated by the old company that had always been its nearest concern, the Lehigh Coal and Navigation Company. Following the close of business in 1931 the Old Company returned it again to the Commonwealth, which has designated it a State Park and has undertaken its preservation and restoration.[7] Preserved along its route, together with the locks and ditches, waste gates and bridges are the splendid scenic setting and the history, lore and legend with which the very soil and air seem impregnated. To walk its banks in a fair season, to breathe hay-scented air of a gentler time - the hand-wrought, time worn appurtenances induce a kind of bucolic rapture and a hundred or more years fall away.

Morris Canal

Another in the chain of anthracite waterways, the Morris Canal was completed in November, 1831, a few months ahead of the Delaware Division Canal. Among the old canals the Morris attained the third highest altitude:[8] 913 feet above sea level at its summit near Lake Hopatcong. Its fiscal career followed a less elevated course, trending

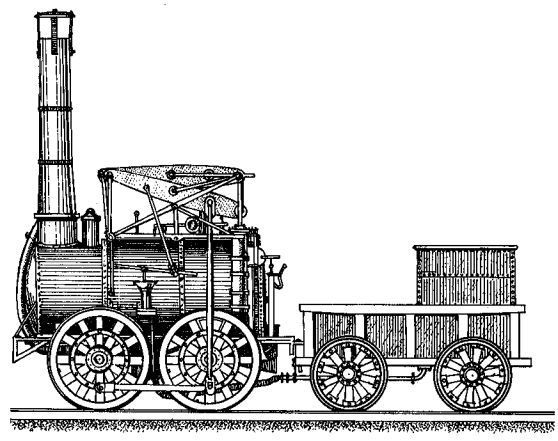


A freight boat begins the ascent of an inclined plane on the Morris Canal at Boonton, New Jersey. As an alternative to surmount this lift of 82 feet, nine or ten locks would have been required.

rather downward from the outset. The basic error made in laying out its original structures was a repetition of the Union Canal's costly mistake. Only the reason was different. The anticipated potential water supply for the Morris far exceeded its needs; the small channel and locks were the result of a dearth of funds - not a lack of water.

English engineer James Renwick resolved the grade problem by adoption of a system of inclined planes, twenty-three of which were required to surmount the major elevations. An equal number of conventional locks negotiated the lesser grades. The canal's circuitous course stretched out 102 miles from Phillipsburg to Newark Bay for a route which measures 55 miles by air. The channel section was 32 feet wide at top, 20 feet at bottom and four feet deep. Robert Fulton, ten years deceased, had endorsed the use of inclined planes, which he predicted would replace canal locks, and by which "the most mountainous region and the most appalling elevations will be traversed with ease." Inclined planes did, in fact, prove to be more efficient and less expensive than locks, at least in the case of the Morris. Lifting power was provided by turbine water wheels fed by Lake Hopatcong's prodigal supply.

The Morris Canal and Banking Company went into bankruptcy in 1841, only ten years after the Canal's opening. Reasons for its failure included spurious promotion of the project's assets and potential, leading to the disenchantment and eventual desertion of financial backers; wildcat speculation and



The Stourbridge Lion, first steam locomotive to run on rails in the Western Hemisphere.

certain criminal promotion schemes carried on by the Banking Company. For three years the canal existed in a kind of limbo, operated by transient lessees. A new company was formed in 1844 and the canal was given a needed refurbishing. Enlargement of the locks permitted transit of 44-ton boats, the former capacity having been 25 tons.

Renovations made between 1847 and 1860 boosted handling capacity to 60 - 70 ton units by rebuilding the planes and replacing hemp rope with wire hoisting cable. Tonnage for 1860 was 707,631; the total for 1845 had been 60,000 tons. The new improvements were effective, but historic hindsight tells us they were too late. A scant half dozen years remained to reach the peak of traffic: in 1866, 900,000 tons, mostly anthracite, were hauled. At this time freight trains of the Lehigh Valley Railroad could complete in eight hours a trip requiring more than four days for canal boats. In 1871 the Lehigh Valley Railroad took a lease in perpetuity on all the properties of the Morris Canal and Banking Company. Traffic dwindled thereafter to 90,000 tons in 1902, and a year later the State of New Jersey assumed control of the canal works. In 1924 the State ordered the canal's elimination. The work of effacement was thorough.

Delaware and Hudson Canal

The original plan of Benjamin Wright and his survey engineers John L. Sullivan and John B. Mills was to use slackwater navigation on Lackawaxen River between Honesdale and the Delaware River. Economy dictated this plan and others, namely to terminate the canal at Honesdale, 17 miles short of the mines and to build the locks of wood. Fair fortunes and good management favored the Delaware and Hudson from the beginning. Good luck in the form of cement, discovered in Lower Rondout Valley, brought about a timely decision to build the locks of stone. Addition of John B. Jervis to the staff secured the valuable engineering experience of yet another Erie Canal man. Initially assistant to Chief Engineer Wright, he quickly succeeded to the Chief's post, as that busy man moved to other projects. A review of the Lackawaxen's characteristics persuaded engineers that slackwater navigation was impracticable. The decision was made to cut a canal along the entire route.

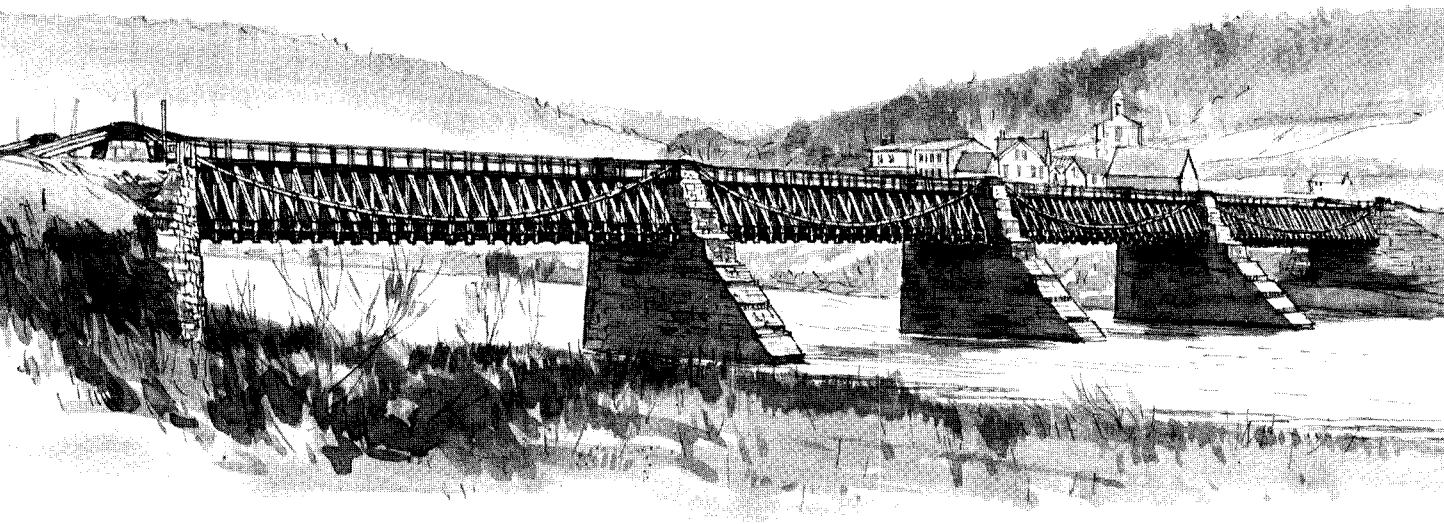
The canal's length was 108 miles, of which about 60 miles were in New York State, between the eastern terminus at Rondout on the Hudson River and Minisink Ford on the Delaware above Port Jervis, where it crossed the Delaware by means of a dam and slackwater—and later, by a unique suspension aqueduct. Here, at the mouth of Lackawaxen River, the canal started its steady climb to Honesdale. The last leg of the route, 16-7/8 miles across the 850-foot high watershed divide, was traversed on rails by John Jervis' ingenious system of inclined planes. Five of the planes powered by stationary steam engines, covered the ascending trip to the mines at Carbondale; descending, the loaded cars rolled by gravity down three planes, one of which had a pitch of 500 feet to the mile. Jervis devised a propeller of canvas on frames and mounted it on the cars, so articulated to the running gear as to effect a reverse rotation of the propeller and drag the cars' speed down to an average four miles per hour.

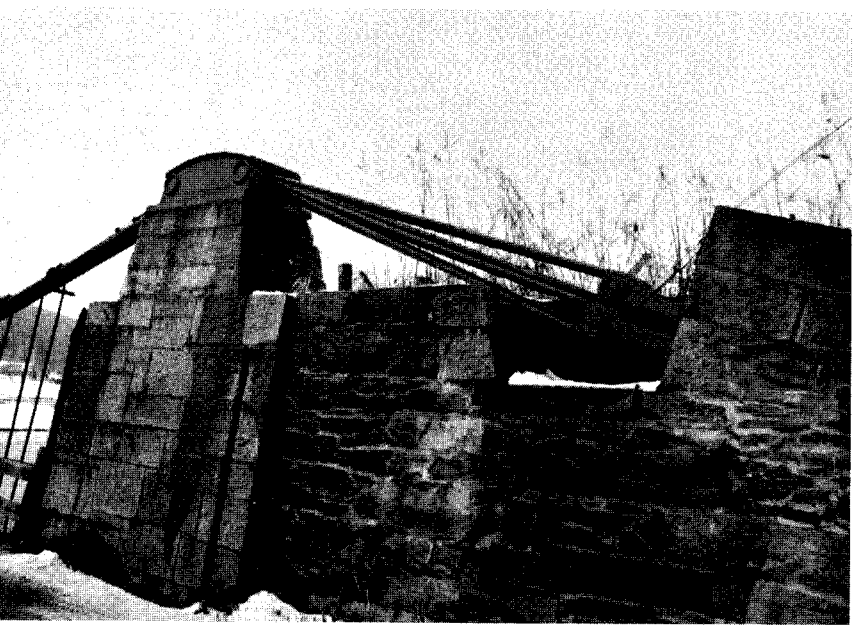
The men who guided the affairs of the D & H through the early years seem to have been a consistent breed. Single-minded, long-headed and tenacious, all apparently concentrated their undivided efforts on financial success: the Wurtz brothers, William and Maurice, who bought Wyoming coal lands in 1812 at prices of $.50 to $3.00 per acre; who hand-mined the black stones and with fanatic zeal expounded their excellence to Philadelphians and New Yorkers; Phillip Hone, the Company's first president and subsequent Mayor of New York; John, the third Wurtz brother and second president, whose administration (1831-58) went through a business depression, miner's strikes, competition wars and a cholera epidemic and saw the Company reestablished, paying an eight percent dividend in 1839 and on the way to prosperity.

Consistent too were the Erie engineering talents: White, Mills and Jervis; and later on, President Bolton and engineer Horatio Allen. Their basic formula for success may have been grounded in the strategic timing of major company's moves. The original canal, built between 1825 and 1828, had prism dimensions of 32 to 36 feet at waterline, 20 feet at bottom and was four feet deep. Its 110 locks had an average lift of ten feet, accommodating 30-ton boats. The Canal was twice rebuilt, eventually enabling it to handle vessels with a capacity of 140 tons. These same men engineered improvements on other canal projects which had subsequently languished; with the D & H each change was followed by a spectacular increase of business. From a depression year low of 43,000 tons in 1834 the Company began its uninterrupted climb to the highest annual tonnage in the canal's history: 2,930,333 tons in 1872.

Two years prior to that peak year the Delaware & Hudson purchased the Albany and Susquehanna Railroad. Typically realistic, the Company prepared to phase out a transport system which was showing symptoms of obsolescence. Railroads were everywhere proving their value and the D & H was in the "Lackawanna Coal" business - not the canal business. Their first railroad venture had been similarly unsentimental. In August 1829, Horatio Allen had tested the famous "Stourbridge Lion" at Honesdale, Pa. The trial runs of the English-built locomotive over the gravity railroad's tracks of hemlock stringers and strap iron were reputedly the first operations of any railroad locomotive in the United States. The tests proved the eight-ton engine too heavy for the railway; the cost of rebuilding the road was considered exorbitant. With a practical sense of unhistory the "Lion" was dismantled, its boiler sent to work in the Company shop at Carbondale and the rest of it left to rust in a shed alongside the tracks.

With the letting of contracts on 5 October 1870 for construction of the Lackawanna and Susquehanna Railroad the D & H launched into a program of railway construction and acquisition, accumulating 900 miles of railroad by 1930. The anthracite business was better than ever, but the canal had become an unnecessary burden. In April 1899 the New York State Leglislature permitted abandonment of the canal works and excision of "canal" from the corporate name. In June of that year, Mr. S.D. Coykendall of the Cornell Steamboat Company bought the Canal for $10,000.





John Roebling designed the suspension aqueduct which carried the Delaware and Hudson Canal across the Delaware River at Lackawaxen, Pa. Built in 1847, it bore boat traffic until the canal was abandoned in 1898. Today, stripped of its wooden trunk, it serves as a link for vehicular traffic between New York and Pennsylvania.

Today, little remains of the upriver canals except pictures, records and a few vague ditches and crumbling locks. Commerical navigation and passenger transport are minor considerations in the new plans for exploiting the basin's tributary streams. While on another plane, the new projects are no less vital to the region's economic and sociological well-being than the 19th century canals had been. The projects, including protection against floods and pollution and maintenance of area water supplies, continue the tradition of stream utilization for the public good.